

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

This amendment changes claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

Claims 1 and 3 have been amended. Claim 3 has been amended to improve its readability without narrowing its scope. No new matter has been added.

After amending the claims as set forth above, claims 1-11 are now pending in this application.

Rejections under 35 U.S.C. §§ 102 and 103

Claims 1, 5-6 and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 01081198 A to Nagai (hereafter “Nagai”) in view of JP 61185750 A to Mitsushima (hereafter “Mitsushima”). Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Nagai and Mitsushima, and further in view of “Development of neutral-beam-assisted etcher” to Yunogami (hereafter “Yunogami”). Claims 3, 4, 7 and 10-11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nagai and Mitsushima, and further in view of U.S. Patent No. 4,775,789 to Albridge, Jr. et al. (hereafter “Albridge”). Claim 8 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Nagai and Mitsushima, and further in view of U.S. Patent No. 4,859,908 to Yoshida et al. (hereafter “Yoshida”). Applicants respectfully traverse these rejections for at least the following reasons.

Independent claim 1 is directed to an etching apparatus using a neutral beam. The apparatus includes a grid having a plurality of grid holes and a reflector having a plurality of reflector passages. The reflector passages communicate with the grid holes such that the ion beam passing through the grid holes is reflected by the surfaces of the reflector passages and the ion beam is neutralized into a neutral beam. Furthermore, the reflector is attached to the

grid. Neither Nagai nor Mitsushima discloses this feature of claim 1, nor its attendant advantages.

Nagai discloses an ion source 21 that accelerates an ion beam 23 through an ion discharge hole 22, and a neutralizer 24 of metallic boards 25. The beam impinges on the boards at an angle θ (see abstract).

Mitsushima discloses a source chamber 11 supplying H^+ ions. The ions from the source chamber 11 are shaped to parallel beams by a grid 13 (see abstract).

Even if Nagai and Mitsushima were combined, however, the combination would still not meet the limitations of claim 1, because neither Nagai nor Mitsushima suggests that a reflector, which acts to neutralize an ion beam that has passed through grid holes of a grid, is attached to the grid.

Moreover, attaching the reflector to the grid provides advantages not suggested by Nagai or Mitsushima. As disclosed in the present specification on page 4, lines 3-8, attaching the grid to the reflector can prevent contamination generated due to unnecessary leakage of ions. Nagai and Mitsushima, failing to suggest attaching a reflector as recited to the grid as recited, also fail to suggest the advantages of doing so.

Moreover, it would not have been obvious to replace the single hole 23 in the Nagai device with a grid such as the grid 13 disclosed by Mitsushima. Nagai discloses a prior art structure in Figure 3 with a grid having a number of holes. Nagai appears to disclose that the structure of Figures 1 and 2 is an improvement over the structure of Figure 3. Thus, Nagai teaches away from including a grid in his device, and it would not have been obvious to have included a grid in the Nagai device for at least this reason.

Yunogami was cited for allegedly disclosing a retarding grid, but fails to cure the deficiencies of Nagai and Mitsushima.

Albridge also fails to cure the deficiencies of Nagai and Mitsushima. Albridge was cited for allegedly disclosing an etching apparatus with a number of reflector passages, but also fails to suggest attaching a reflector as recited in claim 1 to the grid as recited.

Yoshida also fails to cure the deficiencies of Nagai and Mitsushima. Yoshida was cited for allegedly disclosing an etching apparatus with a number of reflector passages, but also fails to suggest attaching a reflector as recited in claim 1 to the grid as recited.

The dependent claims ultimately depend from claim 1 and are patentable for at least the same reasons, as well as for further patentable features recited therein.

For example, claim 3 requires that each reflector passage has a circular cross-section. The Office Action appears to rely on Albridge for the disclosure of a reflector with passages having a circular cross section. While Albridge discloses in Fig. 5 a set of concentric plates, any passages between these plates has an annular cross-section, not circular.

Dependent claim 10 requires that an angle between a central axis of the reflector passages and the advancing direction of the ion beam is from 5 to 15°. The Office Action relies on Albridge for teaching this feature, and cites specifically to Albridge at col. 3, lines 26-55. Albridge discloses, however, that the highest efficiency is for an angle of between 1 and 4° (col. 3, lines 33-34). Thus, Albridge teaches away from increasing the angle to be between 5 and 15°, and instead suggests that the angle should be between 1 and 4°.

The Office Action indicates on page 5 that it would have been obvious to provide the reflector passages of Nagai in view of Mitsushima with a reflector angle between 5° and 15° as taught by Albridge in order to achieve a desired percentage of neutralization. Applicants disagree. As stated above, Albridge teaches away from increasing the angle to be between 5 and 15°, and instead suggests that the angle should be between 1 and 4° to have the highest efficiency.

With respect to claim 11, the Office Action acknowledges that Nagai in view of Mitsushima and Albridge fail to disclose the diameter of the reflector passage being equal to or greater than the respective grid hole. The above references, however, fail to disclose anything about the relative size or shape of any passages through a reflector that neutralizes ions to holes in a grid. Neither the plates of Nagai nor Albridge disclose any circular holes that might be aligned with a grid. While Albridge discloses annular passages in Fig. 5, these passages would not align with any of the grid holes of the grid disclosed in Mitsushima

Moreover, none of these references provide any suggestion as to aligning holes in a grid with corresponding passages in the plate structures of Nagai or Mitsushima, much less with the specific shapes and relative sizes as recited in claim 11.

Applicants believe that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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